since Bubak,[2] in his description of this alfalfa leaf-spot, states that a perithecium does not contain more than three or four asci; while, in the material at hand, the number varies from 8 to 14. Furthermore, the ascospore and ascus measurements do not agree entirely with those given by Pollacci,[1] or Bubak. Pollacci first reported and named the fungus in Italy. He does not give the number of asci in a perithecium, and his ascospore and ascus measurements do not agree with those by Bubak, although the latter regards the species as the same. Puttmans[3] describes a variety, naming it *Pleosphærulina Briosiana* Pollacci **var.** *Brasiliensis* Puttmans nov. f. He regards it as different from *Pleosphærulina Briosiana* Pollacci, in that the ascus and ascospore measurements are larger. Among the seven species under the genus *Pleosphærulina,* described by Saccardo,[4] including *Briosiana,* nothing further is elucidated.

A description of this alfalfa leaf-spot as it occurs in Kansas is as follows: The spots are scattered irregularly over the entire leaf surface, frequently causing spots along the margins. These spots are generally circular or elliptical, from 1 to 5 mm. in diameter. During the earliest perceptible stages, the spots appear as very small, dark-reddish-brown spots. These soon increase in size, a dark-brown margin bounding the ashen-gray center of the spot. The centers of these spots may vary from a light tan color to ashen-gray. This tissue does not fall out, but remains intact. The spots are confined almost exclusively to the leaves, but the fungus does attack the petioles. The perithecia are visible to the unaided eye if they are mature, appearing as very small black dots. They occur rather sparingly, irregularly and promiscuously scattered within the centers of the spots. They are more or less membranous, partially immersed, erumpent, globular to oblong, slightly pyriform, glabrous, dark brown to black, 100–120μ in diameter. The asci are ovoid in shape, varying from 8 to 12 in number, and measuring 56–75μ long, and 38–42μ wide. There are no paraphyses, which fact distinguishes this fungus from the genus *Catharinia.* The asci are supplied with a pedicel at the base, with which they are attached to the wall of the perithecium. Each ascus is provided with a peculiar tongue-like projection at the apex, this being a striking characteristic. This does not appear to be described or mentioned, so far as the writer has been able to find, in Pollacci's description of this fungus. The ascopores measure 12–14μ wide, and 30–32μ long. They are generally arranged so that 5 ascospores are located at the base and larger end of the ascus, and 3 in the upper or narrower part. The spores are multicellular, oblong, fusiform, conspicuously granular, and greenish-hyaline, and having from 3 to 4 septa, and from 1 to 3 longitudinal divisions, making from 5 to 7 cells, rarely 8.

This leaf-spot may prove to be of considerable economic importance, since like the *Pseudopeziza* leaf-spot, it causes destruction of the foliage.

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[4] Sylloge Fungorum., Vol. XI., XIV., XVI. and XVII.

DIFFERENTIATION OF WANDERING MESENCHYMAL CELLS IN THE LIVING YOLK-SAC

THE yolk-sac of the teleost egg is a particularly favorable object for observing the movements and migrations of cells in the developing embryo. Such a yolk-sac has only one really definite continuous membranous cell layer, the ectoderm; a true endodermal layer is absent, though a superficial syncytium, the periblast, fuses with the actual yolk surface. The mesodermal layer is represented by numerous separate wandering mesenchymal cells. These freely wandering mesenchymal cells may be clearly observed through the perfectly transparent ectoderm as they move over the surface of the periblast.

The writer has attempted a detailed study of the movements of the mesenchyme cells and their manner of development and differentiation on the yolk-sac. Observations have been made on the normal embryos from the earliest stages at which the mesenchyme wanders out upon the yolk up to the late embryo in which a com-

plex vitelline circulation is fully established, and all of the products of the yolk mesenchyme completely differentiated. The study has been greatly facilitated by a comparison of the normal embryos with specimens in which the circulation of the blood was experimentally prevented from taking place. In such specimens the cells on the yolk-sac never became confused or contaminated with other cellular elements introduced by the circulating blood. The wandering cells may thus be completely followed through all stages in their isolated position.

In the first place, I can not resist the impulse to highly recommend that all students of hematogenesis spend some time at least in a study of living mesenchymal cells and their histogenesis. Such a study will soon convince one of the great disadvantages under which an investigator labors in attempting to solve the origin of blood from observations on dead material in serial sections. The problem becomes so simplified and devoid of laborious uninstructive technique that it seems almost superficial. One may learn as much from the living yolk-sac in an hour of careful study as in almost a week's perusal of sections. Most important is the fact that certain things may actually be seen to occur that sections could scarcely stimulate the mind to imagine. The only disadvanage is that the worker may be led to wonder whether so apparently simple a problem is actually of scientific importance. Fortunately, this mental state is soon passed over on realizing the necessary care and precaution which must be taken in following the movements and changes in the living cells.

Each cell is to be recognized as a living complex and the observer will realize the importance as well as the difficulties of thoroughly understanding and interpreting correctly its manifold changes and behavior. Material which to some extent allows such a study is often available. The *Fundulus* yolk-sac, however, is exceptionally adapted to this study on account of the beautiful simplicity of its structure, as well as the remarkable clearness with which each cell may be observed.

The results of this investigation of wandering mesenchymal cells may be summarized as follows:

The wandering cells begin to migrate away from the embryonic shield or line of the embryonic body at an early period, when the embryo is about forty hours old, the germ ring having almost completely passed over the yolk sphere to enclose its vegetal pole. The cells migrate away chiefly from the caudal end of the embryo, only a few wandering out from the head region. The regions of the yolk-sac thus suggest an area opaca about the tail end and an area pellucida around the neighborhood of the head.

All of the cells wander into the so-called subgerminal cavity, the space Wilson[1] and others consider a late stage of the segmentation cavity, between the yolk-sac ectoderm and the periblast syncytium.

When the cells first appear they are all closely similar in shape and about the same size. Very soon, however, they begin to exhibit certain differences. Many become elongate spindle cells with delicate filamentous processes, sometimes producing a stellate appearance. Others are more ameboid in shape with conical pseudopod-like processes which are constantly being thrown out at one place and withdrawn at another. Still a third class of cells appears somewhat later than the other two; these are more circular in outline with short pseudopods and are more slowly moving.

The movements of these extremely numerous cells and their changes of position may be readily followed with a high magnification. In embryos of about sixty hours, still some time before the heart begins to beat or the blood to flow, four clearly distinct types of cells can be recognized among these originally similar mesenchymal cells, and the further history of the four types may be completely traced.

The ameboid cells with conical pseudopod-like processes shortly after sixty hours begin to show an accumulation of pigment granules within their cytoplasm. Just at this time they are seen to be of two distinct varieties,

[1] Wilson, H. V., "The Embryology of the Sea Bass (*Serranus atrarius*)," *Bull. U. S. Fish Com.*, 1891.

one depositing a black and the other a brownish-red pigment.

The black chromatophore increases rapidly in size and by the end of the third day becomes an enormous ameboid body wandering over the yolk. These cells are attracted to the walls of blood vessels and plasma-filled spaces, such as the pericardial cavity becomes in individuals without a blood circulation. When the embryo is five days old the chromatophores are abundantly arranged along the walls of the vitelline vessels, but the pigmented cells are distinctly separate. After this time neighboring cells begin to fuse along their adjacent borders and large pigment syncytia are formed which completely surround and ensheath the vessels. A single syncytium is often of considerable extent.

The brown chromatophores have a somewhat different history. They never become so massive as the black, and their processes are more delicate and graceful in appearance. Yet these cells also attain a large size and in embryos of 72 hours are scattered over the entire yolk-surface. After the third day when the blood begins to flow in the yolk vessels, the brown chromatophores likewise become attracted to the vessel wall. These exquisitely branched cells apply themselves to the wall of the vessel and may often completely surround it. This type of chromatophore, however, always maintains its cellular individuality and never fuses with other cells to form a syncytium, as is the case with the black type.

The function of the chromatophores on the yolk-sac is most difficult to decide, but one thing is certain, they never become changed into any type of blood cell. The brown chromatophore in early stages may accidentally reach the blood current; it then becomes spherical and may readily be observed for a long time on account of its huge size as compared with the blood cells. It never, however, changes in type.

In specimens without a circulation of the blood both types of chromatophores arise in a normal manner and differentiate normally. Their arrangement along the vessel walls fails to occur. The chromatophores, therefore, remain scattered over the yolk or collected about the plasma filled spaces. The heart in such embryos is sheathed with pigment, while the normal heart never has a chromatophore on it.

The elongate spindle cells with their delicate filamentous processes are small in comparison with the two chromatophore types. These spindle cells retain in general their original appearance, but their behavior is most important. In embryos of about forty-eight hours such cells aggregate into certain rather definite groups; later, the groups become more linear in shape and finally these lines of cells arrange themselves so as to form tubular vessels. Several of the larger vessels arise independently upon the yolk, and certain ones of them later become connected with the venous end of the heart, while in all cases capillary nets which also arise independently become connected with the larger vessels. These processes may actually be followed through every step in the living yolk-sac.

The wall of the early vessels is very irregular, with spaces existing between the component cells. Corpuscles are often caught in these spaces or are entangled in the filamentous processes of the endothelial cells. Such conditions in sections would appear as though the corpuscles actually formed a part of the endothelial wall and might incorrectly be interpreted as endothelial cells changing into blood cells. Nothing has been seen in the living embryos to indicate that an endothelial cell has the power to produce a blood cell or to change into a blood cell of any type, but much has been seen to the contrary.

The generalization strikingly made by Thoma[2] that larger vessels arise from a network of capillaries is not true for the large vitelline vessels of the fish yolk-sac. In the specimens without a circulation of the blood the vessels arise and increase in size and persist for a long time without ever experiencing any effect of the blood current upon their walls.

[2] Thoma, R., "Untersuchungen ueber die Histogenese und Histomechanik des Gefässsystems," Stuttgart, 1893, and "Text-Book of General Pathology and Pathological Anatomy," trans. by Bruce, London, 1896.

In many embryos the circulation after having begun may stop for a time and then later be reestablished, the vessels having persisted in a normal condition. Thoma's so-called laws of vessel formation are, therefore, rudely violated by the development of the vascular system in these embryos.

The vessels arising from independent mesenchymal cells in the space of the blastocele in the teleost yolk-sac entirely overthrow any notion that vessels arise ontogenetically as portions of the celomic epithelium. The vascular lumen is originally continuous with the primary body cavity, the segmentation cavity, and never with the secondary body cavity, or celomic cavity.

The fourth class of cells wander out from the embryonic body somewhat later than the three former types. These are small circular cells with short pseudopod-like processes. They move very slowly, but finally collect into groups on the posterior and ventral regions of the yolk-sphere.

The round cells wander away only from the caudal region of the embryo and probably are derived from the so-called intermediate cell mass which is the anlage of the red blood corpuscles in the fish embryo.

The groups of round cells are slow in their differentiation but just before the circulation of the blood begins, they are seen to be circular erythroblasts. The observer may follow the disappearance of the islands of cells one by one as they are enclosed by the vessels and swept into the circulating stream. About the fifth day these circular erythroblasts become flattened ellipsoidal erythrocytes filled with hemoglobin, the typical red blood corpuscle. The complete change from wandering, more or less globular mesenchymal cells into typical hemoglobin-bearing corpuscles may be followed in the living yolk-sac.

In several instances the body proper of the embryo failed to develop or else degenerated very early, yet the yolk-sac formed or persisted with numerous blood islands fully differentiated.

The embryos in which there has been no circulation of the blood form the blood islands from the wandering cells on the yolk-sac, and the constituent elements of these islands differentiate perfectly and may maintain their red color for many days. Yet they never leave the locality in which they have differentiated. The fully formed red blood corpuscles have little if any power of migrating. When the observer can be positive that the blood has never circulated, and this requires very consistent watching, the blood islands of the yolk-sac are always limited to certain regions, and never occur so far anteriorly on the ventral surface of the yolk as to reach the venous end of the heart.

Finally, we may consider the study of the developmental products of the early wandering mesenchymal cells on the yolk-sac of the *Fundulus* embryo as a problem of cell lineage followed to its ultimate end. The primordial mesoderm cell or cells carry within their bodies all the potentialities of the mesoderm and may give rise to a series of cells which are capable of developing muscle, cartilage, bone, connective tissue proper, blood cells, vessels, etc. Yet after a few cell generations the individuals in the series derived from these early cells containing all the mesodermal potentialities no doubt become somewhat limited as to their potentialities. In a certain generation there may be definite cells more or less generally distributed which possess the capacity to give rise to muscle cells, but to no other type of mesodermal tissues. Still later in development these cells may become even more limited in their developmental capacities and thus have the power to produce only a certain type of muscle cell and no other type.

Collections of such cells would then be designated embryologically as the anlage of striated muscle, smooth muscle or heart muscle, as the case might be. Yet it is not to be forgotten that at this stage there might be really no means of distinguishing between the several different types of mesodermal cells.

Limitization of potentialities in the individual mesenchymal cells has apparently reached a comparable stage just about the time when the cells begin to wander upon the yolk-sac of *Fundulus*. We have seen these cells as

they wander out and have noted how very soon they may be separated into four distinctly different types, and following the development and behavior of these types it has seemed evident that they are entirely separate and do not intergrade or transmutate. The black chromatophore does not change its nature or divide off other cells which become different in type from the parent cell. Neither do the endothelial cells lining the vessel walls change into chromatophores or into erythroblasts, or vice versa.

From the observations on these yolk-sacs we must conclude that the four types of cells described above have developed from four different anlagen, although these anlagen were not necessarily localized groups of cells, but were diffusely scattered mesenchymal cells capable of developing into a definite product, either normal or abnormal, depending upon the nature of the developmental environment. Therefore, the four distinct mesenchymal anlagen each gives rise to a perfectly typical and distinct cell type, although all develop in, as far as is possible to judge, an identical environment, the cavity of the yolk-sac between the ectoderm and the periblastic syncytium. The differences among the four cell types produced are from the standpoint of our present knowledge in all probability due to the potential differences among the apparently similar mesenchymal cells from which they arose. The four types including endothelial cells and erythrocytes we must consider, from an embryological standpoint, as being polyphyletic in origin.

C. R. STOCKARD

WOODS HOLE, MASS.,
September 15, 1915

ANTHROPOLOGY AT THE SAN FRANCISCO MEETING

A SPECIAL meeting of the American Anthropological Association was held in the Museum of Greek Sculpture and Anthropology, University of California, Berkeley, August 3 to 5, 1915, in affiliation with Section H and the American Anthropological Association. In the absence of Professor A. L. Kroeber, chairman of the committee on program, Professor T. T. Waterman, vice-chairman, presided. Although the program was a comparatively short one, the attendance at the meetings was large.

Papers of interest to anthropologists were also read before the joint meeting of the American Psychological Association and Section H; and before the Archeological Institute of America. However, the abstracts which follow will be confined entirely to the papers read before the Anthropological Association. For example, among the papers read before the Archeological Institute should be mentioned "Ancient Mexican Spindle-whorls," by Mrs. Nuttall, which was illustrated by an exhibit of two hundred specimens, as well as by reference to one of Lord Kingsborough's volumes; "Life Forms in the Pottery of the Southwest," by Mrs. Harry L. Wilson; "Aspects of Neolithic Culture of the Santa Barbara Channel Islands, California," by Hector Alliot; "Latest Work of the School of American Archeology at Quirigua, Guatemala"; and "Archeology at the Panama-California Exposition," by Edgar L. Hewett; and "The Unpublished Material in the Mayance and Southern Mexican Languages," by Wm. E. Gates.

The papers read before the American Anthropological Association included: "A Demonstration of the Skull of an Ancient San Diegan Indian Showing the Largest Coronoid Index yet Recorded" (by title), by J. C. Thompson; "Differences in Papago and Pima Coiled Basketry" (by title), by Mary Lois Kissell; "Kumana, a Primitive Corner of Japan, and Its Folk-Lore, as Studied by Mr. Minkata" (by title), by W. T. Swingle; and "The Significance of the Present Forward Movement in China," by Yamei Kin.

Abstracts of all the other papers presented follow:

The Miwok Moieties: E. W. GIFFORD.

The Central Sierra Miwok Indians of the Sierra Nevada Mountains of California are divided into exogamous moieties with paternal descent. Each moiety is associated through the personal names of its members with either the "water" or the "land" side of nature, this division of nature being more or less arbitrary. The object after which a person is named does not appear, as a rule, in the name itself; it does appear, however, in the connotation of the name. The connection thus existing between the moiety and a group of natural objects lends a totemic aspect to the Miwok moieties, which is supported by a myth attributing the parentage of the founders to the bear and the coyote. The moieties are practically impotent as